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Changes in Perennial Grass Cover Following Conversion from Yearlong to Summer-Deferred Grazing in West Central New Mexico¹

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The Rio Puerco drainage in west central New Mexico has been heavily used by livestock since the days of the early Spanish settlers.³ Under close, yearlong grazing the vegetation deteriorated.

To determine whether improved management might help to rehabilitate those lands, livestock were excluded from three experimental watersheds during summer months over a 6-year period. Changes in the ground cover index during that time are compared with those during a 6-year period under yearlong grazing. The watersheds were used to test recovery as a cooperative project with the Bureau of Land Management.

¹Research reported here was conducted in cooperation with the Bureau of Land Management, U. S. Department of Interior.

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³Dortignac, E. J. Watershed resources and problems of the Upper Rio Grande Basin. 107 pp., illus. Rocky Mountain Forest and Range Expt. Sta., Ft. Collins, Colo. 1956.

Study Site

The San Luis experimental site lies in the north central portion of the Rio Puerco drainage, 58 miles northwest of Albuquerque, New Mexico, in the transition zone between semi-desert grassland and woodland. The three watersheds are: WS I, 555 acres, WS II, 471 acres, and WS III, 338 acres. Annual precipitation for the area averages around 10 inches. The soils, which are alluvial, were derived principally from Mancos shale and cretaceous sandstone and are now severely gullied.

Principal forage species are alkali sacaton (Sporobolus airoides Torr.), galleta (Hilaria jamesii (Torr.) Benth.), and blue grama (Bouteloua gracilis (H. B. K.) Lag.). Fourwing saltbush (Atriplex canescens (Pursh) Nutt.) and big sagebrush (Artemisia tridentata Nutt.) are the principal shrubs.

Methods of Study

During the 6-year period ending May 1, 1957, the three watersheds were grazed by cattle yearlong; during the next 6 years they were grazed during winter months only (November through April).

Herbage production of each of the principal forage species was determined each fall after the first frost by a weight-estimate⁴ and double-sampling technique.⁵ Weight of each species, in grams, was estimated on nine permanent 9.6-square-foot plots at each of 25 sampling spots randomly located on each of the three watersheds. At the sampling spot, weight of herbage on a tenth 9.6-square-foot plot was estimated; then the herbage was clipped and weighed. The relationship between estimated and actual weights was used to adjust the estimate of the herbage weight on permanent plots.

Stocking rates were adjusted annually on the basis of herbage production. The objective was to utilize 55 percent of alkali sacaton.

Utilization was estimated about May 1 each year by the ocular estimate-by-plot method.⁶ Mesh wire utilization cages, 9.6 square feet in size, were located at each sampling spot. They were relocated each spring on previously grazed spots to insure that new summer growth was measured. The cages provided examples of ungrazed forage at each site to help the examiner judge utilization.

Ground cover index was taken on 24 clusters of three 100-foot transects randomly distributed over each of the three watersheds. Records from them provided an index to changes in the three principal grass species. Measurements were taken in 1952, 1955, 1958, 1961, and 1963.

A network of nine open standard and four recording rain gages distributed over the three watersheds provided precipitation records. Precipitation was measured weekly from May 1 to November 1. The overwinter meas-

urement period extended from November 1 to May 1 of each year.

Results

Utilization

Annual utilization varied widely, but much more under yearlong grazing than under deferred grazing. During the 6 years of continuous yearlong grazing, average utilization of alkali sacaton ranged from 11 to 87 percent in comparison with 32 to 70 percent under summer-deferred (November through April) use only (table 1).

Table 1.--Utilization of alkali sacaton on San Luis watersheds under yearlong and summer-deferred grazing

Grazing pattern and year	WS I	WS II	WS III	Average
- - - - Percent - - - -				
Yearlong grazing:				
1952	50.0	60.0	65.0	58.3
1953	24.0	24.0	25.0	24.3
1954	23.0	10.0	0	11.0
1955	47.6	48.0	38.2	44.6
1956	38.6	45.4	33.8	39.3
1957	87.0	87.7	87.2	87.3
Summer-deferred grazing:				
1958	37.0	27.7	31.8	32.2
1959	54.2	48.2	59.7	54.0
1960	71.5	70.0	69.6	70.4
1961	61.9	44.6	39.0	48.5
1962	40.1	34.2	40.0	38.1
1963	57.0	46.8	59.4	54.4

Precipitation

Annual precipitation fluctuated yearly, but the averages for the two periods of study are similar. From 1952 to 1957 annual precipitation averaged 9.83 inches; during the second period precipitation averaged 9.38 inches. Average annual precipitation (year beginning November 1) and growing-season precipitation (May 1 to November 1) are shown below:

⁴Pechanec, J. F. and Pickford, G. D. A weight estimate method for the determination of range or pasture production. *Amer. Soc. Agron. Jour.* 29(1): 894-904. 1937.

⁵Wilm, H. G., Costello, D. F., and Klipple, G. E. Estimating forage yield by the double-sampling method. *Amer. Soc. Agron. Jour.* 36: 194-203. 1944.

⁶Pechanec, J. F. and Pickford, G. D. A comparison of some methods used in determining percentage utilization of range grasses. *Jour. Agr. Res.* 54: 753-765. 1937.

	Average precipitation	
	Annual (inches)	Growing season (inches)
Yearlong grazing:		
1953-54	12.12	8.24
1954-55	6.86	5.95
1955-56	5.92	2.21
1956-57	12.23	8.35
1957-58	12.00	6.53
Summer-deferred grazing:		
1958-59	10.66	6.81
1959-60	10.28	5.33
1960-61	10.32	9.31
1961-62	6.47	2.70
1962-63	9.19	4.15

Ground Cover Changes Under Yearlong Grazing

During the yearlong grazing, ground cover index declined. Reductions for individual species ranged from 15 to 56 percent (table 2).

Table 2. --Ground cover index of the three principal grasses on the San Luis watersheds

Species and year	WS I	WS II	WS III	Average
----- Percent -----				

Alkali sacaton:

1952	1.00	1.51	2.47	1.66
1955	.74	1.28	2.24	1.42
1958	.56	1.06	1.67	1.10
1961	2.21	3.45	3.17	2.94*
1963	3.11	6.41	5.67	5.06*

Galleta:

1952	2.92	2.13	1.75	2.27
1955	3.51	2.21	1.53	2.42
1958	3.22	1.42	1.17	1.94
1961	6.60	3.49	2.18	4.09*
1963	12.55	8.43	4.61	8.53*

Blue grama:

1952	3.28	1.26	.36	1.63
1955	2.10	.61	.44	1.05
1958	1.47	.48	.19	.71
1961	3.15	.96	.53	1.55*
1963	4.25	1.43	.63	2.10*

*Increases were significant at .01 level.

Measurements taken in 1958 showed a greater decline in blue grama than in the other two species. Blue grama was reduced by 56 percent from the 1952 value, while galleta averaged a 15 percent decline and alkali sacaton a 34 percent decline during this period.

Ground Cover Changes Under Deferred Grazing

Under summer deferment, the ground cover index showed a marked change (table 2). Alkali sacaton increased 400 percent, with individual gains of 455, 505, and 240 percent for the respective watersheds. Galleta increased by 290 percent in WS I, 494 percent in WS II, and 294 percent in WS III. For the entire study area galleta increased an average of 359 percent. Average increase for blue grama was 206 percent, a percentage representing gains of 189 percent for WS I, 198 percent for WS II, and 232 percent for WS III.

Tests of summer-deferred grazing resulted in significant increases in cover index compared with yearlong grazing. Although these tests lacked control of utilization and weather elements, the change from a declining ground cover index to an increasing one suggests conversion from yearlong to summer-deferred grazing was beneficial. This change in grazing was mainly responsible for the ground cover increases in alkali sacaton, galleta, and blue grama.

Summary and Conclusions

1. Ground cover changes, production, and utilization of alkali sacaton, galleta, and blue grama were measured during 6 years of yearlong grazing and then during 6 years of summer-deferred grazing.
2. Under yearlong grazing, these perennial grasses declined; under summer-deferred grazing, they increased.
3. The evidence indicates that summer deferment of grazing may be a means of improving the condition of similar rangelands in New Mexico.

